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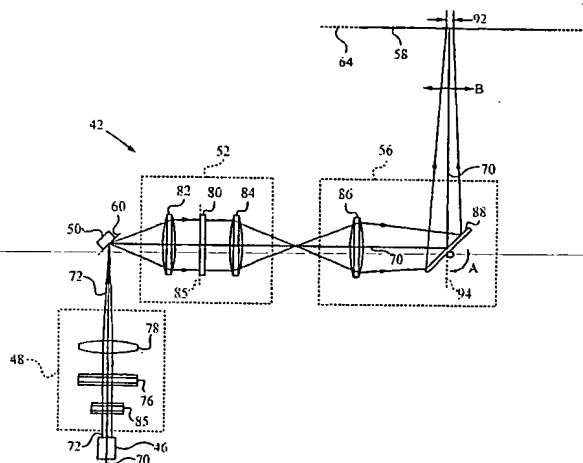
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(54) Title: ANGLED ILLUMINATION FOR A SINGLE ORDER GLV BASED PROJECTION SYSTEM



(57) Abstract: A display apparatus projects a two dimensional image onto a display screen and includes illumination optics, a light modulator, separating optics and scanning optics. The light modulator is optically coupled to the illumination optics such that in operation the illumination optics illuminate the light modulator with an off-axis illumination and further such that the light modulator directs light onto an optic axis for a bright pixel, thereby forming on-axis light, and away from the optic axis for a dark pixel, thereby forming off-axis light. The separating optics are coupled to the light modulator and separate the off-axis and on-axis light where the on-axis light produces a real and virtual image that is displayed by the projection and scanning optics.

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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 629 801 A (BLOOM DAVID M ET AL)	25-30
Y	13 May 1997 (1997-05-13) abstract	1-13, 15-23, 31-38, 14, 24
A	claims 1-4 figures 2-4	
Y	US 5 982 553 A (BLOOM DAVID M ET AL)	1-7, 15-21, 31-38
A	9 November 1999 (1999-11-09) cited in the application abstract figures	8-14, 22-30

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	EP 1 014 143 A (EASTMAN KODAK CO) 28 June 2000 (2000-06-28) abstract page 6, line 28 - line 37 figure 8	8-13,22, 23 14,24
A	EP 0 436 738 A (JAPAN BROADCASTING CORP) 17 July 1991 (1991-07-17) abstract figures 1,4-7	1-38
A	GLASER T ET AL: "BEAM SWITCHING WITH BINARY SINGLE-ORDER DIFFRACTIVE GRATINGS" OPTICS LETTERS, OPTICAL SOCIETY OF AMERICA, WASHINGTON, US, vol. 23, no. 24, 15 December 1998 (1998-12-15), pages 1933-1935, XP000802142 ISSN: 0146-9592 figure 1	1-38
A	US 6 091 521 A (POPOVICH MILAN M) 18 July 2000 (2000-07-18) abstract column 2, line 46 - line 64 column 5, line 15 - line 20 figures 2,3,5	1-38
A	US 4 724 467 A (MARSHALL SIDNEY W ET AL) 9 February 1988 (1988-02-09) column 5, line 37 - line 43 figures 1,2	1-38
A	WO 97 26569 A (UNIV LELAND STANFORD JUNIOR) 24 July 1997 (1997-07-24) abstract figures 7,21,22,27,28	1-38
A	US 5 825 443 A (OHOKA TADAO ET AL) 20 October 1998 (1998-10-20) figures 1,2,20,22	1-38
A	US 5 798 805 A (OOI YOSHIHARU ET AL) 25 August 1998 (1998-08-25) abstract figures 15,30	1-38
A	US 6 025 859 A (IDE ATSUSHI ET AL) 15 February 2000 (2000-02-15) abstract figures 1A,1B,11A,22	1-38

INT NATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 02/09604

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5629801	A	13-05-1997	AT 200712 T	15-05-2001
			AU 5981096 A	30-12-1996
			CN 1187248 A ,B	08-07-1998
			DE 69612554 D1	23-05-2001
			DE 69612554 T2	23-08-2001
			EP 0830628 A1	25-03-1998
			JP 2941952 B2	30-08-1999
			JP 10510373 T	06-10-1998
			NO 975694 A	06-02-1998
			WO 9641224 A1	19-12-1996
US 5982553	A	09-11-1999	AU 6569098 A	12-10-1998
			CN 1251178 T	19-04-2000
			DE 69803656 D1	14-03-2002
			DE 69803656 T2	13-06-2002
			DK 968453 T3	25-03-2002
			EP 0968453 A1	05-01-2000
			JP 2000513114 T	03-10-2000
			NO 994515 A	17-09-1999
			WO 9841893 A1	24-09-1998
EP 1014143	A	28-06-2000	US 2001015850 A1	23-08-2001
			DE 69901420 D1	13-06-2002
			EP 1014143 A1	28-06-2000
			JP 2000180737 A	30-06-2000
EP 0436738	A	17-07-1991	DE 69023217 D1	30-11-1995
			DE 69023217 T2	18-07-1996
			EP 0436738 A1	17-07-1991
			JP 2980372 B2	22-11-1999
			WO 9102429 A1	21-02-1991
			KR 185729 B1	01-05-1999
			US 5260815 A	09-11-1993
US 6091521	A	18-07-2000	AU 1706600 A	08-05-2000
			WO 0023834 A1	27-04-2000
US 4724467	A	09-02-1988	DE 3413644 A1	11-10-1984
			GB 2140648 A ,B	28-11-1984
			JP 1801631 C	12-11-1993
			JP 5005672 B	22-01-1993
			JP 59206819 A	22-11-1984
WO 9726569	A	24-07-1997	US 6219015 B1	17-04-2001
			AT 217094 T	15-05-2002
			CA 2243347 A1	24-07-1997
			DE 69712311 D1	06-06-2002
			DE 69712311 T2	19-12-2002
			EP 0875010 A2	04-11-1998
			JP 2001518198 T	09-10-2001
			WO 9726569 A2	24-07-1997
			US 5808797 A	15-09-1998
US 5825443	A	20-10-1998	JP 9230321 A	05-09-1997
US 5798805	A	25-08-1998	JP 8201757 A	09-08-1996
US 6025859	A	15-02-2000	JP 9174933 A	08-07-1997

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6025859	A	JP 3290877 B2	10-06-2002
		JP 9183255 A	15-07-1997